[From THE MEDICAL NEWS, April 2, 1887.]

THE TREATMENT OF AFFECTIONS OF THE RESPIRATORY PASSAGES AND OF BLOOD-POISONINGS BY GASEOUS ENEMATA.

A Clinical Demonstration before the members of the Philadelphia County Medical Society, at the German Hospital of Philadelphia, March 30, 1887.

BY J. SOLIS-COHEN, M.D.,
PRESIDENT OF THE SOCIETY.

IT is now some four years since Dr. L. Bergeon, lately Professor in the Medical School of Lyons, commenced a series of experiments in the treatment of pulmonary consumption, by injections of hydrogen sulphide in small quantities, propelled by currents of recently prepared carbon dioxide (carbonic acid gas of the old nomenclature). On the 12th of July of last year, he communicated his results to the Académie des Sciences,[1] and on the 20th of August to the Congress of the French Association for the Advancement of Sciences. On the 19th of October, Professor Cornil read a paper on the subject before the Parisian Academy of Medicine.[2] The bene-

[1] Comptes rendus, July 12, p. 176.
[2] Bull. de l'acad., 2 me. sér. xvi.

ficial results claimed therein have been confirmed by a number of French physicians, and have been favorably commented on by Dr. J. Henry Bennet, of Paris. A letter from Dr. Bennett in the *British Medical Journal* for December 18, 1886, so strongly impressed me that I wrote to Paris at once for an apparatus, having previously procured a pamphlet on the subject by his pupil Dr. V. Morel, of Lyons, who devised the apparatus which will be used before you; and from whose pamphlet[1] I have obtained most of the information that I propose to communicate—much of it in his own phraseology.

Mr. Kyner, of the Polyclinic, has made for me and for some of my friends, a number of apparatus imitated from this one of Morel, which answer just as well, and which can be procured for $10, less than one-half the cost of the imported one.

I have them in use in this hospital, in St. Joseph's Hospital, in the Home for Consumptives, in the Hospital of the Polyclinic, and in private practice. While unprepared, at this early date, to express a positive opinion as to the value of the method in curing consumption, I do not hesitate to state that sufficient evidence exists to demonstrate its value as a legitimate therapeutic measure; and I have invited you to a clinical demonstration because it is of importance that those of you who have not had access to the original sources of information should see how the administrations are made, in order that you should not submit yourselves to unnecessary disappointment should you feel disposed to give the method a trial, as I believe you should do. As you will see, the process is simple, but requires some precautions which necessitate the presence of the medical attendant at the first few administrations.

---

[1] Nouveau traitement des affections des Voies Respiratoires et des Intoxications du Sang par les injections gazeuses, d'après la Méthode du Dr. L. Bergeon. Paris, 1886.

The principle upon which the treatment is based is that the disastrous results of pulmonary tuberculosis are due to septicæmia set up by absorption of the noxious products of suppuration in ulcerous lesions in contact with the atmospheric air; and that repeated prolonged bathings of the suppurating surfaces with a safe antiseptic agent, controls the suppuration and gives the lesions an opportunity to undergo cicatrization. When an attempt is made to administer such an agent by inhalation, the quantity required to produce the desired effect is so large that it is poisonous to the individual. The same may be said of administrations by the stomach, or by the subcutaneous connective tissue. Dr. Bergeon, reasoning on some experiments reported by Claude Bernard in 1857,[1] has found that certain antiseptic agents, of which he has found hydrogen sulphide the best, can be administered in sufficient quantities by the rectum with impunity, provided that care is taken not to introduce too much at a time. Claude Bernard demonstrated that when a toxic or medicinal agent is introduced into an organ at a distance from the arterial system—the digestive tube, for example—it could not penetrate into the arterial system because it becomes eliminated before it can reach that system. It has to traverse the portal system, the liver, the hepatic veins, and the pulmonary tissue; during which transit it may be eliminated in the liver by the bile, or, if volatile, in the lungs by exhalation. To demonstrate this point, Bernard rapidly poisoned a bird by enclosing it in a bell glass containing hydrogen sulphide; and then he injected a syringeful of the gas into the veins of a dog with impunity; and, with like impunity, a solution saturated with hydrogen sulphide into the rectum of a dog. In both these instances the gas was detected in elimination

[1] Leçons sur les substances toxiques et médicamenteuses.

within a few seconds by blackening a paper saturated with plumbic acetate and held before the muzzle of the animal, and elimination had ceased at the end of five minutes. Hence he came to the conclusion that this substance could be safely introduced into the digestive tube or into the veins, provided care be taken not to introduce too great a quantity at a time.

The first experiments of Dr. Bergeon were made on animals with chlorine, turpentine, ether, ammonia, and bromine; but these agents had to be abandoned because they soon produced a violent inflammation of the rectum, and even points of sphacelus in the mucous membrane. On the other hand, a mixture of carbon dioxide and sulphuretted hydrogen was thoroughly tolerated when these two gases were pure and completely deprived of admixture with atmospheric air. In their union, the carbon dioxide plays somewhat the part of an inert agent, and attenuates the irritant properties of the hydrogen sulphide. Sulphur is well known as a powerful microbicide long recommended in pulmonary disease. Carbonic acid gas is likewise rapidly absorbed by the venous system, and rapidly eliminated by the lungs, provided it is injected slowly and in small quantity. The good effects of carbonic acid gas in pulmonary phthisis, in asthma, and in other affections, have long been known to the profession, as I had occasion to refer to it some twenty years ago in the first edition of my little *Treatise on Inhalation*, and in which I referred, likewise, to some experiments made by Dr. James Collins and myself. In addition to this, the anæsthetic effect of carbonic acid gas may have some influence in preventing colic of the intestine in the introduction of the gas, and in subduing irritation in the pulmonary tract in its elimination. Those of you who, like myself, have been practising medicine in Philadelphia some twenty-five years or more, may remember the experiments as to

the anæsthetic effects of carbonic acid gas made by the late Dr. Demmé, at that time Demonstrator of Anatomy in the Pennsylvania Medical College.

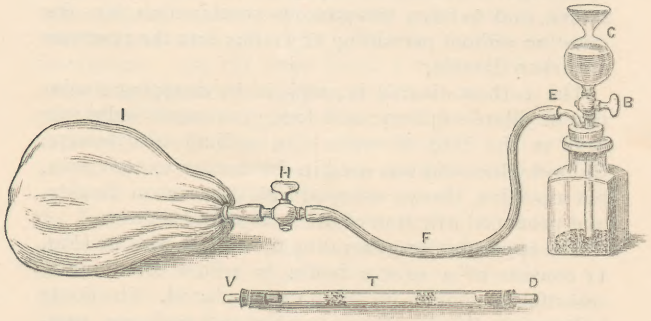
Dr. Morel's apparatus for administering gaseous enemata, is based on the principle that a current of carbon dioxide passing over certain gaseous or volatile substances produces a disassociation of the gaseous elements, and drives them forward with it. It is necessary to produce a pure carbon dioxide; and then to pass it through a medicated liquid or over a volatile substance, and to force this gaseous combination into the intestine without permitting any reflux into the reservoir of carbon dioxide.

The carbon dioxide is prepared by dropping a solution of dilute sulphuric acid (200 grammes of sulphuric acid to the litre of water) on sodium bicarbonate. Chlorohydric acid was used in the earlier experiments, but a portion always escaped with the carbon dioxide, and produced irritation of the rectum and kidneys.

The apparatus for generating the carbon dioxide (Fig. 1) consists of a square bottle in which three tablespoonfuls of sodium bicarbonate are placed. The bottle is hermetically closed by a rubber cork with two apertures, through one of which a glass tube extends to the bottom of the bottle, the upper portion (C) being expanded into a funnel and reservoir for the dilute sulphuric acid, beneath which is a glass stopcock (B) to regulate the descent of the liquid. The second aperture in the cork is filled with a curved glass tube (E) for the escape of the gas, and this exit tube is prolonged by a section of rubber tubing (F) for attachment to a rubber bag (I) of six litres capacity, in which the carbonic acid gas is to be collected. The mouth of this bag is furnished with a stopcock (H). The sodium bicarbonate being placed in the bottle, the cork is inserted, and the stopcock of the sulphuric acid reservoir is closed. This re-

servoir is then filled with the dilute sulphuric acid, say four ounces, and the stopcock is turned so as to allow the acid to drip on the soda. The carbonic acid gas is evolved immediately, the activity of the disengagement being controlled by the stopcock. A little gas is allowed to escape into the atmosphere, so as to drive off the atmospheric air in the bottle. Meanwhile the reservoir is rolled tightly so as to drive out all the air it contains, as

FIG. 1.



Carbon dioxide generator and reservoir.

Glass tube, containing volatile medicament between two tampons of cotton.

T. Medicament.

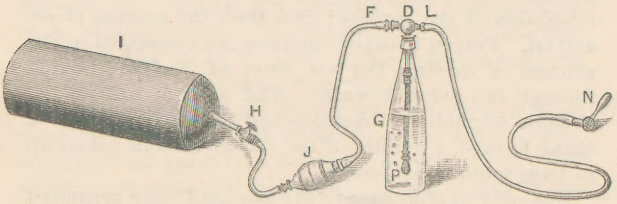
V. D. Connections.

far as possible, and is then attached to the exit tube for the gas and allowed to become filled with the carbonic acid. It is then removed and its stopcock is closed. It must be removed before the stopcock is turned, in order that pent-up gas in the bottle shall not break the apparatus. This is one of the points to which the physician must direct the attention of his nurse, before entrusting the patient to the attendant. Another point upon which

stress must be distinctly laid, is the rolling of the bag to prevent retention of atmospheric air.

The gas is now ready for use. The reservoir (I) is attached to a handball aspirator (J) with check valves at each end (Fig. 2). This is attached to a metallic T tube (D) passing through a cork which is intended to be placed in the neck of a bottle containing the medicated

FIG. 2.



solution, preferably a highly charged natural sulphur water. The vertical portion of the tube is furnished with a double valve (P) to prevent aspiration of the liquid through which the carbonic acid gas bubbles, and contains an orifice at top for the escape of the gas into the distal horizontal branch, to which is attached a tube (L) connected with a nozzle (N) for introduction into the rectum. As this tube could not be made here in time to supply me with the number of instruments I required, Mr. Kyner, Superintendent of the Polyclinic, has imitated the contrivance at my suggestion by two glass tubes placed in the cork just as in the cork of a modified Wolff bottle; the longer tube being supplied with a valve to prevent regurgitation. It answers equally well with the original. This T branch is placed in a bottle three-fourths filled with the sulphurous water—in this instance the Red Sulphur Spring water, of Virginia—and the aspirator is worked two or three times to

drive out the atmospheric air in the bottle, another point to which the physician must emphatically direct the attention of his nurse. The nozzle is then inserted into the rectum of the recumbent patient and the injection made slowly. All clothing must be loose. With the hand on the abdomen, the amount of distention of the colon is noted, and when this is marked, or when pain is complained of, the process is suspended until absorption takes place, as manifested by relaxation of the tension; and then the process is resumed. Fifteen to twenty minutes are consumed in the process of driving the six litres of carbon dioxide through the sulphur water. The sulphur salt—*e. g.*, sodium sulphide—is decomposed, hydrogen sulphide being formed, a portion of the carbon dioxide taken up to form sodium carbonates.

The only modification of the process I have permitted myself (for I deem it due in justice to Dr. Bergeon and Dr. Morel to test their method of administering the gas in their own way) is to place the mineral water bottle in a bath of warm water, which renders the injection more grateful. Within four minutes, sometimes within one, the sulphuretted hydrogen can be perceived in the breath, and be detected by paper saturated with plumbic acetate. It is prudent to have a bed-pan at hand in case there should be a call to stool. The injection should not be made upon the full stomach. This may produce emesis, it is said. You want all the room possible in the abdomen to prevent pressure upon a distended stomach and upon the diaphragm.

Three or four hours after a meal, or just before one, is the best time for injection. Two injections are given daily. I have found three hours after breakfast and three hours after supper the best periods. My patients have slept better after an injection just before bedtime, than after one, three or four hours after the midday meal.

At the first injections but half the contents of the reservoir of carbonic acid should be used, so that the parts and the system may be gradually accustomed to the process.

If the bottle of sulphurous water remain strongly impregnated after the injection, it may be tightly corked for use a second time. It is not necessary to have the bowels moved before an injection. Hæmoptysis and the presence of the menstrual period do not contraindicate the process. Indeed, Dr. Bergeon has seen amenorrhœa relieved during this treatment, even when that condition had failed to yield to the ordinary methods of treatment for that special condition.

When the pulmonary lesions are extensive, and, in consequence, elimination of the gas takes place slowly, the injections must be made very slowly, or they will produce sensations of fulness in the thorax and in the abdomen.

Now, as to therapeutic results. All published observations recount rapid amelioration of the suppurative phenomena; a marked diminution in cough, expectoration, dyspnœa, and night-sweats, being noted within two or three days. Similar prompt improvement, with reduction of temperature, has been noted in some of my own cases, not in all. Some of his more than 200 patients Dr. Bergeon considers cured. These, he states, no longer expectorate, and present no other stethoscopic evidences than the dry sounds due to cicatrized or cicatrizing cavities, or to cicatricial bands consecutive to old lesions. Some of them have been able to resume laborious occupations, and to ascend several flights of stairs many times a day without injury to their respiratory apparatus, or loss of the ameliorated condition which had been secured. Some who considered themselves cured at the end of a few weeks, abandoned treatment, despite the advice of Dr. Bergeon,

and underwent recurrence. It is, therefore, important that the treatment should be continued for some months, until all the pulmonary lesions have been cured, lest incompletely cicatrized surfaces undergo suppuration afresh, and reproduce septicæmia. They should be renewed from time to time, even after apparent cure, and especially upon any reappearance of cough, expectoration, fever, or emaciation.

Not only are pulmonary lesions said to be cured by these enemata, but pharyngeal and laryngeal tuberculous ulcerations are said to undergo cure likewise, and that without any topical applications whatever, simply from the contact of the gas in its elimination from the lungs.

Of the cases treated under my own supervision I have as yet little positive to state. With a single exception, they have done quite well so far, and some of them are very pronounced cases—cases that I have had no hope of benefiting very greatly by any treatment with which I am more familiar. One of my patients insists that she is well, but she is not. Some of these cases are here for the purpose of receiving the treatment in your presence. They will answer for themselves that they are better in several ways. Hope of recovery has much to do with this, but not all. I went through a similar experience more than twenty years ago with inhalations of oxygen in phthisis. Hope buoyed the patients up until they found that oxygen had not the power of curing them, and then some of them, I fear, sank all the sooner for the disappointment. In the present instance the prospect is better, the treatment being more in accord with scientific principles, despite the awkwardness of the method. Try it, gentlemen, and within a few months Philadelphia will be able to prove whether this treatment is to be regarded as a novelty of the moment, or whether it has the therapeutic value that has been claimed for it.

In the one instance, it is hardly to be supposed that your patients will have been injured; in the other, they will have had all the advantage of an early resort to a beneficial agent.

Should it be desired to administer some volatile medicament, as iodoform, carbon sulphide, eucalyptol, or the like, the bottle of mineral water is replaced by a bottle of common or distilled water, and between the T-tube and the injection-pipe a glass tube is inserted, in which the volatile substance has been introduced between two tampons of cotton. (Fig. 1, V, T, D.)

In addition to pulmonary phthisis, the following diseases are said to be usefully treated by this method, the therapeutic principle being the same in all of them: asthma, whooping-cough, bronchitis, pulmonary catarrh, typhoid fever, the eruptive fevers, puerperal fever, and general septicæmia. If this be true, the list can be extended, as stated by Dr. Morel. The gas acts on the mass of infected blood in the right cavities of the heart, and upon its entire transit through the ramifications of the pulmonary artery, so that the venous blood is disinfected in its course to the pulmonary alveoli and reënters the branches of the pulmonary veins in a purer condition.